PRINCIPLES AND OBSERVATIONS

APPLIED TO THE

MANUFACTURE AND INSPECTION

OF

POT AND PEARL ASHES.

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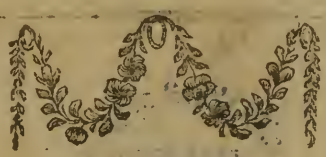

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THE following obſervations relate to an extenſive buſineſs; and are deſigned, in the plaineſt manner, to convey profitable information to thoſe intereſted in it, who have not leiſure or opportunity to ſearch for the principles therein contained, in the writings of profeſſional Chemiſts.

PRINCIPLES AND OBSERVATIONS.

POT and Pearl Aſhes have for a long time been amongſt the moſt valuable articles of manufacture and commerce in this part of our country.

To preſerve and improve ſo great a branch of buſineſs is an object intereſting and important to this Commonwealth, and, as ſuch, has employed the attention of the Legiſlature. "An Act to aſcertain the quality of Pot and Pearl Aſhes, and for the more effectual Inſpection of the ſame," is intended to effect this ſalutary purpoſe; and the operation of it ought to remedy evils which have deprived our citizens of the commercial advantage of their own manufacture, and our manufacturers of the higheſt market price for their Aſhes, unleſs they tranſported them to the State of New-York for inſpection. For, under our old law, the inſpection was ſuperficial. The conſequence was, that the moſt indifferent Aſhes came to our market; even the refuſe from New-York was often brought to Maſſachuſetts for exportation; while it became an object to many, who ſought a market for Aſhes of the firſt quality, to ſend them

from

from Maſſachuſetts, by an expenſive tranſportation, that their real value might be ſtamped upon them by the ſuperiour credit of the New-York *brand*. A difference of price current obtained between New-York and Maſſachuſetts Aſhes, both in Europe and America ; and Aſhes exported under the advantage of the New-York brand, would ſell from three to four pounds per ton higher than that from Maſſachuſetts.

To put a ſtop to this ruinous traffic, the Legiſlature thought proper to frame the new law, adopting a mode of inſpection ſimilar to that practiſed in the State of New-York, that we might participate of the benefits naturally reſulting to us from this important export.

Much therefore depends on the execution of this law, and it may be of uſe to enquire into the principles on which the inſpection and examination are conducted, that they may be fairly and generally underſtood.

The excellence of Pot and Pearl Aſhes is in proportion to the quantity and purity of the alkaline ſalt they contain ; and, it appears, that in this proportion they are eſtimated by thoſe who conſume them.

The very beſt kind is ſought after by chemiſts and druggiſts,—for the bleaching of fine threads, linens and cottons—and for the manufacture of the fineſt glaſs.

The dyers and calico printers require ſuch as will not impart colour, or leave the leaſt ſtain or tinge in their work.

PEARL

PEARL ASH, *First* SORT.

THIS is the alkaline ſalt in a *mild* ſtate, and in a high degree of purity. It is a perfectly white ſubſtance, uniform in its texture and appearance thoughout, diſſolves eaſily in water, gives a clear and colourleſs fluid without ſediment, except a very ſmall portion of white earth, ſuch as is depoſited on every ſolution of the pureſt alkaline ſalt that can be obtained; and containing ſo little of neutral ſalts as neither to be injured by them in its uſe, nor depreciated in its value by their weight. Such as this is ſupplied in great quantities from many of our manufactories, and commands the higheſt price.

PEARL ASH, *Second* SORT.

SOME Pearl Aſh falls ſhort of this high degree of purity, not being properly calcined, or, as the term is, *pearled* throughout. If pearled in kettles, the finer part is an heavy meal-like ſubſtance; the lumps, hard and flinty; the whole of a yellow or greeniſh caſt. If pearled in the oven, and not properly manufactured, it is generally very blue, not eaſily diſſolved, and unlike that large light porous lump ſo much preferred in the London market. Another kind, is of a dull dead white, inclining to grey, occaſioned by not ſettling the lye, or by dipping it ſo as to diſturb the ſediment, of which a very little will

diffuſe

diffuſe throughout, and materially depreciate a very large quantity of Pearl Aſh. All theſe however are valuable, being rich in the genuine ſalt, and are uſed in a variety of bleaching, and for many purpoſes which make them in demand; but not at the firſt price; therefore, they are denominated the ſecond ſort.

PEARL ASH, *Third* SORT.

WHEN the appearance of Pearl Aſh is totally different from the above deſcription, is of various colours, hard of ſolution, and the ſolution charged with colouring matter, depoſiting a dirty, dark ſediment, it is unfit for the nicer purpoſes in the arts, and therefore, ſuffers ſuch a reduction of price, as operates to the exceeding loſs and injury of the manufacturer, if imprudently he offers it at market. Whenever Pearl Aſh, under the beſt appearance, is found to contain a great portion of neutral ſalts, it is undervalued accordingly.

POT ASH.

THERE are many articles bleached, of ſo firm a fabric, as not to be ſufficiently acted upon by the alkaline ſalt, in a mild ſtate. To be thoroughly whitened, they require a greater degree of *cauſticity*.

The manufacture of ſoap alſo creates an immenſe demand for the *cauſtic* alkali, a quality in the alkali neceſſary to diſſolve the oil or fat in the compoſition of ſoap, and render it miſcible with water.

Our

Our *Pot Aſh* is this cauſtic alkali. The appearance of it, very different from Pearl, ſoon changes from the action of the air upon its ſurface; therefore, to form the firſt opinion of it by the eye, it is neceſſary to break the lumps.

POT ASH, *Firſt* SORT.

THE beſt is generally of a light ſtone grey, or marbled white and grey, with a cryſtaline core; cauſtic or burning to the touch, and, although in appearance like a ſtone, and almoſt as hard, it ſo greedily attracts moiſture from the air, that when expoſed to it but for a ſhort time the ſurface of this ſtone-like ſubſtance completely diſſolves. This, which is denominated firſt ſort of Pot Aſh, is however very far from being a pure ſalt; as any one may eaſily obſerve, by letting a ſolution of it reſt, until it depoſits a ſediment. Yet, it is the beſt that is generally ſent to the market, and until there is a further improvement of this manufacture, muſt be conſidered as the ſtandard.

POT ASH, *Second* SORT.

BESIDE the foregoing, there are large quantities of Pot Aſh, of different degrees of purity, of various colours, that, on examination, merely by the eye, ſhew marks of heterogeneous mixture, ariſing from want of ſufficient attention to what is called by the manufacturer, ſettling the lyes; whereby

whereby the finer earthy parts of the wood-aſhes get enveloped with the ſalt : or, for want of proper management of the fire, not continuing it long enough, or not raiſing it ſufficiently to deſtroy what the workmen call the ſulphur. This ſulphur which is the inflammable or black colouring matter, is moſt injurious to the purity of the alkaline ſalt, and cannot be ſeparated from it in large manufactories, but by fire, as is hereafter explained.

This impurity, in its different degrees, is ſeen at once, by the different ſhades of red it gives the Pot Aſh. In the brighteſt pink coloured, where it is clear, without an edging of coal black, or mixed or marbled with light grey, the black colouring matter is in ſo ſmall degree that it is placed with the firſt ſort. If it is of a deeper red, it ſhews a greater quantity of this colouring matter, and by wetting a piece of it, and rubbing it a little, there may be diſcovered a very conſiderable degree of foulneſs, that is not in the Pot Aſh before deſcribed, and is therefore denominated the ſecond ſort.

POTASH, *Third* Sort.

When Pot Aſh is of ſo deep or dark liver coloured red as to turn black on expoſing it but a ſhort time to the air; or when wet and rubbed, it appears foul and black as the blackeſt ink, interſperſed throughout its whole ſubſtance with ſmall

black

black ſpecks, as if ſprinkled with duſt of charcoal, or imperfectly melted; it is then almoſt as impure as what are called black, or Pot Aſh ſalts.

If, as was obſerved of Pearl Aſh, with the beſt appearance, Pot Aſh contains neutral or foreign ſalts in quantity, it is depreciated accordingly.

The foregoing obſervations contain a very general deſcription of the Pot and Pearl Aſhes brought to the ſeaports of this Commonwealth, for exportation, together with an account of ſome of the uſes to which they are applied. Further remarks may be of uſe to ſome manufacturers of Aſhes, and may perhaps enable them to conduct their buſineſs with more eaſe, ſatisfaction, and certainty of ſucceſs, than they have hitherto been uſed to; whereby they may prevent ſuch great loſs as is ſuſtained in tranſporting ſo heavy an article by land carriage, ſome hundreds of miles, as they ſometimes do, in a *depreciated ſtate*, when it has not been properly manufactured.

That there may be an underſtanding of the principles that ſhould direct in this manufacture, previous to an account of the proceſſes by which Pot and Pearl Aſhes are made, it will be neceſſary to premiſe, that, although all alkaline ſalts obtained from vegetables when abſolutely pure, are preciſely the ſame; yet, there is a difference between Pot and Pearl Aſhes, though made from the ſame lye, which admirably adapts them for different uſes. This difference exiſts in nothing

but the comparative mildneſs of the one, and the cauſticity of the other: therefore, the terms *mild* and *cauſtic* have been uſed, to expreſs the different properties of the ſame alkaline ſalt under different forms. The mild quality depends on a principle, next to fire and water, the moſt active agent in this buſineſs. It has been very little attended to by manufacturers, although long known amongſt chemiſts by the name of gaz, fixable or fixed air, and now generally denominated the aerial acid. This is abſorbed from the common air, often from ſpring water; and Pearl Aſh in its utmoſt ſtate of purity and perfection, is now known by the name of the aerated alkali.

The cauſtic quality of Pot Aſh depends on the abſence of this aerial acid, and ſuggeſts the propriety of the different modes that are practiſed to obtain the ſame alkaline ſalt, well prepared, for different purpoſes. From the beginning, through every ſtage of the manufacture of Pearl Aſh, this aerial principle applies itſelf, and its operation will be particularly attended to, when we come to the pearling proceſs.

The common hard wood throughout this country furniſhes alkaline ſalt in great abundance: what is called ſoft wood, ſuch as every ſpecies of pine, is well known to yield but little.* From the

* S. Blodget, Eſq; now living in Haverhill, formerly a ſcientific manufacturer of Aſhes in this town, has beſtowed indefatigable attention on experiments, that ſhew the different quantities of ſalts produced from different ſorts of wood, growin

the manner of burning wood, either abroad in the open air, as in clearing up the land, or in chimneys, for common fuel, it is evident, that when reduced to wood aſhes, the contained ſalt muſt be blended with a variety of ſubſtances, which conſtitute its impurity. In this ſtate the manufacturer receives it. It is his buſineſs to free it from theſe foreign ſubſtances; and in proportion as he effects their ſeparation, will be the excellence of his Pot or Pearl Aſh.

Although theſe ſubſtances of impurity are almoſt infinite, yet they may be claſſed under three heads; 1ſt. Some earthy ſubſtances inſoluble in water. 2d. Colouring matter. 3d. Neutral ſalts.†

As the difference between Pot and Pearl Aſhes has been ſtated to be but a different manufacture of the ſame ſalt; whereby it acquires the different properties already noticed, the two proceſſes for their manufacture muſt be treated of ſeparately; therefore, the firſt obſervations will be confined to the proceſs for the manufacture of Pearl Aſh.

Experienced

he has been careful to preſerve, as uſeful knowledge, which, together with other facts his accurate obſervation has furniſhed, or his experience confirmed, it is hoped he will be induced to communicate.

† Another ſource of impurity not mentioned above, though it might be comprehended under the article, colouring matter, is from iron; this united with alkaline ſalt, fixes ſo ſtrong a dye, that the beſt mode hitherto practiſed for its ſeparation will not indemnify the manufacturer of Pot Aſh, for the trouble and expenſe of it. Therefore, although even this may be ſeparated with great care and trouble, it will be moſt for his intereſt, whenever the water to be made uſe of in leeching is found to be from a ſpring impregnated with iron, to ſeek for a new ſupply where it may be had more pure, or give up the attempt to make good Aſhes.

Experienced manufacturers find an eſſential difference in working wood aſhes that have been collected from abroad, or that have been long expoſed to the air; and thoſe that are recently made under furnaces, or even in common chimneys. They remark, that ſalts from wood burned abroad, when clearing up the land, will not eaſily melt, but will pearl without difficulty, and are often determined in their arrangement for making Pearl or Pot Aſh, from this circumſtance. Many conjecture the cauſe of this difference to ariſe from the common earth or dirt which unavoidably mingles with wood aſhes when collected from the ground. But as leeching them and ſettling the lye, ſo as completely to ſeparate all that is earth from the ſalts, does not diſpoſe them to melt, this opinion appears without foundation.

The true cauſe is the principle already hinted at. It is the combination of the aerial acid, which is made evident by a variety of experiments, ſhewing, that wood aſhes, when expoſed to the air of the atmoſphere, freely imbibe this principle from it, and that depriving them of this principle, is ſufficient to render the alkaline ſalt from them cauſtic, and diſpoſes it to melt.

The PROCESS for the MANUFACTURE of PEARL ASH is carried on by ſeveral operations:

LEECHING.

LEECHING.

THE firſt conſiſts in diſſolving and waſhing out all the ſalts from the indiſſoluble earth or dirt, with pure rain or river water, if to be procured; in filtering, or ſtraining it nicely, and in letting all ſediment ſubſide, or ſettling the lye. This is called leeching the wood aſhes.* It is ſo well underſtood and practiſed by many of our manufacturers, that it would be unneceſſary to be minute, did not too many adhere to the old mode of ſinking huge leeching vats under ground. Defects in them are thereby ſo concealed, that a great loſs of lye may be ſuſtained before the workman diſcovers the leak. The heavy compact maſs they contain, is not ſo eaſily ſoaked and waſhed as a ſmaller body: not readily admitting the water throughout its whole ſubſtance, paſſages are ſometimes formed by gutters through various

* It has been ſtrongly recommended to begin this manufacture by calcination, or burning the wood aſhes in an oven or furnace. But the experiments hitherto made, have only ſerved to prove this an expenſive and troubleſome mode, without the advantage boaſted of and promiſed by Mr. S. Hopkins, the author of this ſuppoſed improvement.

Water is the proper ſolvent of all ſalts, and where the combuſtion and incineration of wood aſhes has been complete, it is a fact not to be controverted, that boiling water will thoroughly diſſolve and waſh out all the ſalts, of every kind, blended with the earth in wood aſhes. If the wood has not been completely reduced to aſhes, but to aſhes mixed with coals, then would it not be better, by ſifting them, to ſeparate the coals, which, thrown under the furnace for fuel, would be calcined with profit? Another advantage to be derived from this mode would be, leſſening the quantity of colouring matter that is imparted by coals, &c. therefore would facilitate an after part of the proceſs.

various parts of the vat, where any quantity of water will run without penetrating beyond the neighbourhood of the channels it has made; and although the water paſſes through the aſhes until it becomes taſteleſs, and receives no augmentation of weight (which is the criterion to determine when wood aſhes are leeched) yet much of the contents of ſuch a vat may be ſtrongly impregnated with ſalts.*

A more important objection is, that the lye after it is ſtrained and ſettled cannot be brought to the kettle in that ſtate of purity that is neceſſary, unleſs it is ſettled again; for it muſt be drawn up from the ciſtern by the ſuction of a ſmall pump, or dipped out with a bucket or ladle, either of which, however carefully performed, diſturbs the ſediment, that is always depoſited, although the lye has been well filtered, and renders it foul, beſide occaſioning an increaſe of labour.

Leeching

* It is not improbable that ſome partial experiments with wood aſhes, thus imperfectly leeched, may have given riſe to the opinion that dead aſhes (i. e. ſuch as already have been leeched) might, under the operation of the ſuppoſed improved mode of burning aſhes, afford a ſufficient quantity of alkaline ſalt, for another manufacture of Pearl Aſh.

However the opinion of this extraordinary creation of alkaline ſalt prevailed; its effect was, that although the rational foundation of hope and expectation, (i. e. that the principle on which the new product was to be obtained) was concealed in profound myſtery, hereafter to to be revealed; the idea was ſo captivating as to engage numbers in a new project, who deſtroyed their well conſtructed furnaces, to erect ſuch as on experiment became uſeleſs, and entered into incredible contracts for leeched aſhes, that would not pay for their tranſportation. Within the term of two years, this buſineſs terminated in diſappointment, to the loſs and mortification of all who purſued it.

Leeching is better performed in vats placed above ground, where they are always under the eye and examination of the workman. In ſmall vats, the wood aſhes can be more eaſily and thoroughly drenched than in large ones; inſtead of vats that will contain 80 or 100 buſhels, thoſe that do not exceed 30 are to be preferred.

Each vat is to be provided with a falſe bottom, ſo tightly placed above the true one, as to admit nothing below but what is diſſolved and carried down by the water; for this purpoſe, there ſhould be a number of ſmall holes, cracks or channels, in the falſe bottom, covered over with ſtraw, to prevent the paſſage of the earth while it admits the lye.

The diſtance of the falſe bottom from the true one (which forms a receiver for the lye, and is called the ciſtern of the vat) ſhould not be leſs than ſix or eight inches, that the ſediment which falls, may reſt at the bottom of the ciſtern; while the lye is drawing off from a faucet placed at a convenient diſtance above it. The upper part or body of this vat is to be filled with the wood aſhes, within two or three inches of the top, and as much water is to be poured on them as they will abſorb, and will cover them to the brim of the veſſel. This done over night, the lye may be run off in the morning.

The number of vats ſhould be in proportion to the extent of the manufactory, and the number of kettles employed, ſo that there may be a

conſtant ſupply of ſtrong lye, for boiling down. This part of the buſineſs ſhould be managed after the manner practiſed in diſtilleries, to have a ſucceſſion of a certain number of vats ready to work off, and furniſh every day's boiling: and where it is practicable, they ſhould be ſo arranged that the lye may be conveyed from one vat to the other, and from them into the kettles by a ſpout.

Whenever the lye toward the cloſe of leeching becomes ſo weak as not to pay the expenſe of time and fuel to boil it down, it ſhould be thrown on to another vat until it becomes taſteleſs, and receives no augmentation of weight by the leeching. The vat is then to be emptied, the falſe bottom taken out, the whole examined and cleanſed for uſe again.

The foregoing operation gives a ſolution of all the ſalts of every deſcription that were contained in the wood aſhes, effectually ſeparated from the earthy impurities, but yet combined with the colouring matter. This ſolution is next to be boiled down to the conſiſtence of brown ſugar, to prepare the ſalts for the firſt calcination or ſcorching, which is the ſecond operation, deſigned to ſeparate and deſtroy the colouring matter, and convert black ſalts into white. This colouring matter, known to workmen by the name of ſulphur, ſometimes improperly called the *cauſtic ſulphur*, or *oil*, has been denominated, by the moſt celebrated chemiſts, the inflammable principle,

and is, according to one of them, " the material which, with iron, forms Pruſſian blue in alkaline ſalts, occaſions their impurity, and requires much trouble to be perfectly ſeparated."† In fact, as has been ſaid, it cannot be ſeparated in large manufactories but by fire.

SCORCHING.

FOR this purpoſe, when the ſalts are of the above conſiſtence, they are to be thrown into a furnace ſo conſtructed, as to admit the utmoſt force of flame immediately upon the ſalts, while they are expoſed to a continued current of air.

The furnaces in common uſe for ſcorching and pearling, are well conſtructed; they completely reverberate the flame on the ſalts, at the ſame time that they admit a continued ſtream of air neceſſary in this operation, which is a genuine calcination, and cannot otherwiſe be performed. In this ſituation the ſalts are to be frequently ſtirred, that every part of them may preſent its ſurface to the two powerful agents. A ſtrong fire may be applied, but not ſo intenſe as to melt them. When the ſalts have this tendency, the greateſt care muſt be taken to avoid it, by moderating the fire, and by keeping the door of the furnace open, to expoſe them ſtill more to the air; for if they

 begin

† Chemical Dictionary, Article Pruſſian Blue.

begin to run, it is difficult to proceed with the operation, which, if imperfectly performed, muſt diſappoint the hope of the manufacturer for a ſucceſsful termination of the pearling proceſs.

This firſt calcination is known to be finiſhed, if the ſalts, when wet or diſſolved, have loſt the ſtrong diſagreeable ſmell of black lye, as well as the colour, which is now changed for white.

To separate Neutral Salts.

THE next operation is, to waſh away the colouring matter that has been ſeparated, though not completely deſtroyed by ſcorching, and to ſeparate the neutral ſalts.

Theſe objects are very conveniently effected at one and the ſame time, ſimply by ſolution, in ſuch a quantity of boiling water as will take up the alkaline ſalts, but when cold will not hold the neutral ſalts in ſolution. This point is attained ſufficiently accurate for this manufacture, and depends on the different degrees of ſolubility of different ſalts.* When

* Several kinds of neutral ſalts are found with the alkaline ſalt leeched from wood aſhes; they vary in their quantity and proportion from a variety of circumſtances, according to the kind of wood they are made from, and the ſtate of it when burned. From old dry periſhing wood, the neutral ſalts are in great abundance: If the wood has long been ſoaking in ſea water, uncommon quantities of marine, or ſea ſalt, will be found. Water from wells and ſprings diſſolves different ſalts it meets with in its paſſage through the earth, and when made uſe of inſtead of rain or river water, it increaſes the neutral ſalts,

When ſalts produced from good ſound wood are fairly made, without any deſigned adulteration, a ſolution of them that will weigh a very little more than one quarter heavier than the ſame meaſure of pure rain water, when drawn into a receiver, where it muſt be at reſt until cold, will depoſit the neutral ſalts in chryſtals round it; and while this is taking place, if the ſalts have been well ſcorched, the remaining colouring matter, and all ſediment, will be found to have ſubſided at the bottom of the receiver.

Here it cannot be too ſtrongly impreſſed on the workman to avoid every thing that will in the leaſt degree diſturb the ſediment. It is an object ſo important to be attended to, that it cannot be amiſs to repeat the injunction on this head, that he ought never to take this lye from the receiver by pumping or dipping. He will ever be apt to dip too near, and the ſmalleſt quantity

ſalts, and ſometimes diminiſhes not only the proportion, but the abſolute quantity of alkaline ſalts already obtained in the wood aſhes. Thoſe acquainted with the nature of ſalts readily perceive how this muſt happen, when a neutral ſalt, with an earthy baſis, is diſſolved in an alkaline lye. The earthy part of the neutral ſalt is dropped and exchanged for a portion of the alkaline ſalt taken up to form a new neutral ſalt.

This leſſens the quantity of alkaline ſalt by as much as is taken up to form the new combination, and in exchange for it is added the earthy impurity, while, although the kind of neutral ſalt is different, the quantity remains the ſame. On a fair calculation, this will be found to cauſe no trivial deduction from the real quantity of alkali which might be obtained from the ſame wood aſhes if pure rain water was uſed. On an average five hundred buſhels of wood aſhes are drenched and leeched for a ſingle ton of Pot or Pearl Aſh.

quantity of ſediment raiſed, will diffuſe through the whole ſuch a dull white appearance, more or leſs inclining to grey, as induces a ſuſpicion in the purchaſers of Pearl Aſh, particularly on the other ſide of the water, of a mixture of lime, which ſuſpicion has depreciated great quantities of aſhes otherwiſe good.

This is eaſily avoided, by drawing off the white lye from a faucet placed above the ſediment, as deſcribed under the head of leeching.

It cannot be objected to the above mode of ſeparating the neutral ſalts, that ſome ſmall portions of the alkaline ſalt will be thrown down with them; becauſe, waſhing the cryſtals of neutral ſalts in cold water, not ſufficient in quantity to diſſolve them, will diſſolve the remaining alkaline ſalt, which, with the ſediment, may be thrown on to one of the vats for a new proceſs. By the above mode may be drawn off into the kettles, nicely cleaned to receive it, a pure white lye, to be boiled again down to ſalts for the finiſhing operation, which is the ſecond calcination, called pearling.

PEARLING.

IF ſcorching has been well performed, the pearling operation is made eaſy; being little more than drying the white ſalts in the pearling oven or furnace, with a moderate clear flame. It is

an operation ſimilar to ſcorching, but does not require the ſame force of fire; the ſalts having been previouſly freed from their impurity. When boiled to the conſiſtence of ſalts, they are to be thrown into the pearling furnace, and continued under this laſt operation in the manner they were ſcorched, until they are perfectly whitened, and found to be of the deſcription of the firſt ſort of Pearl Aſh.

It is to be again noticed, that as ſome ſalts are found more tender than others (i. e.) more diſpoſed to melt, they require more particular care and attention to moderate the fire and increaſe their expoſure to the air.

There is another mode of pearling much practiſed of late, which will be found exceptionable, whenever the requiſites for this operation are taken into conſideration. It has already been obſerved that pearling is a genuine calcination; and, that a continued ſtream of air is ſo neceſſary in the operation, that it cannot otherwiſe be performed. It is evident that this cannot well be had in the bottom of a deep kettle; for, when heated, the air is expelled from it. A broad or ſhallow pan would anſwer better; but no contrivance can exceed the furnace that will throw a clear flame directly upon the ſalts.

Beſide that it is impracticable to expoſe the ſalts to ſuch currents of freſh air in the kettle as in the furnace; it is obvious, that when the fire under the kettles is likely to be raiſed too high,

high, by the time the operator is apprized of it, it is often too late to prevent the miſchief it muſt occaſion, on account of the continuing heat of the iron. Therefore, the ſalts, for want of ſufficient expoſure to the air, and by reaſon of too great heat, have not imbibed their portion of the aerial acid, and are thereby rendered cauſtic, and more diſpoſed to melt.

Hence the reaſon, that, although two or three manufacturers, by extraordinary care and caution, have produced Pearl Aſhes of the firſt ſort in this mode; yet, in this way, great quantities have been ſent to market imperfectly pearled; much of it fine, not well dried, heavy, and like meal of a yellow tinge; while the lumps beginning to melt, are externally hardened, and of the ſame or a greeniſh hue.

The cauſticity of this kind of aſhes gives it an appearance of greater ſtrength. But this property cannot be a recommendation of it, while thoſe who uſe it for nicer purpoſes, where the *mild* alkali, or firſt ſort of Pearl Aſh, is required, find it too corroſive, or ſharp, for their work.

This kind of kettled aſhes is in diſrepute in the London market; and on account of its corroſive quality, is ſometimes ſuſpected of being heated with lime. This ſuſpicion, however, muſt be groundleſs; for, did the manufacturer attempt to uſe quicklime in *kettling* aſhes, it would inevitably melt the ſalt.

To

To finiſh the obſervations on the manufacture of Pearl Aſh little remains to be ſaid, except what relates to putting it up or packing it for the market. Neatneſs in this part of the buſineſs quickens the ſale, and often enhances the price of the article, above the difference made in its intrinſic value. The eye of the purchaſer, particularly in the London market, is prejudiced, beyond what is commonly imagined, even againſt good aſhes when not ſhewn to the beſt advantage.*

If Pearl Aſh is tight packed, the lumps are broken, and it is made fine: It is true the property of it is in no degree altered; it is equally as good for every poſſible uſe as though it were in large lumps, ſmoothed by rolling looſely in the caſk; yet it does not meet with the ſame approbation, and has been frequently complained of.

A want of neatneſs, which proves an eſſential injury to Pearl Aſh, is frequently occaſioned by a mixture of ſcorched ſalts: it is impracticable to ſeparate them when repacking, eſpecially if the Pearl Aſh has been pounded almoſt to powder, to crowd the greateſt poſſible quantity into a caſk. This impurity is too often in ſuch proportion as to denominate the Pearl Aſh ſecond ſort.

* A letter lately received from a houſe in London that perhaps deals as largely in aſhes as any one houſe in Europe, contains the following obſervation. "Small aſhes, however pure, will not recommend themſelves in England like bold aſhes of a good colour."

ſort. To prevent it altogether, it is found moſt convenient and beſt to uſe ſeparate furnaces ; one for ſcorching, another for pearling. Where the buſineſs is not ſufficiently extenſive to afford the expenſe of two, the ſingle furnace, after it has been uſed for ſcorching, ſhould be moſt attentively examined, and thoroughly cleanſed of all remains of ſcorched ſalts. The hearth alſo ſhould be noticed, and repaired if neceſſary, that there may be no pieces crumbled from the bricks of the furnace found amongſt the Pearl Aſh.*

By

* Sometime in the courſe of the laſt ſeaſon, amongſt ſix or ſeven caſks of Pearl Aſh ſent to the Inſpection Store, one of them was marked ſecond ſort ; becauſe, with the Pearl Aſh, there were ſmall pieces of brick and mortar that had crumbled from the inſide of the furnace, interſperſed throughout the caſk. The perſon who brought it, alledged that the Pearl Aſh being very good, ſo trifling and accidental a mixture could not materially injure it for uſe ; therefore the ſecond ſort brand would depreciate the value of the Pearl Aſh, and not the few foreign ſubſtances found with it. The owner and the Inſpector, as is very common, differed in opinion, and the Pearl Aſh paſſed as ſecond ſort.

A workman from the glaſs houſe came to the ſtore, examined for himſelf, and liked the appearance of this Pearl Aſh, and it was purchaſed for that manufactory.

When the melted compoſition, wherein this was an ingredient, was to be blown into plates of glaſs, it was ſnapped in pieces by the brick, before the plates could be formed. By which miſchief the blaſt was loſt, and the proprietors, from this ſingle caſk of Pearl Aſh, in one evening ſuſtained an injury to the amount of between 30 and 40 dollars.

BY a different proceſs the ſame alkaline ſalt is obtained in a cauſtic ſtate, and is called

P O T A S H.

IF the eſſential difference between Pearl and Pot Aſhes is the comparative *mildneſs* of the one, and the *cauſticity* of the other; and if the mildneſs of the alkali in Pearl Aſh depends on its combination with the *aerial acid* (a principle it abſorbs from the common air, or from *hard* water uſed in the manufacture of Pearl Aſh) we are at once preſented with a key to that myſtery whereby good Pot Aſh can *always* be made.

Prevent as much as poſſible the combination of this aerial principle with the alkaline ſalt, while paſſing through the different operations, to free it from its impurities: deprive it of what it unavoidably catches, and the proceſs muſt be ſucceſsful.

To prevent then this combination, the wood aſhes, or the ſalts from them, ſhould not be expoſed to the open air; for although the free admiſſion of air is requiſite in calcination, as has been inſiſted on throughout the pearling proceſs; the excluſion of it in fuſion, facilitates that operation; and *melting down*, as it is termed, is well known invariably to ſucceed better the leſs the external air is admitted. The only reaſon why alkaline ſalts ſhould be melted into Pot Aſh, is, that by the force of ſo ſtrong a fire,

the aerial acid may be expelled, that the alkaline ſalt may preſent as ſmall a ſurface to the air as poſſible, and thereby retain its remarkable cauſticity.

This remarkable property is greatly increaſed by the uſe of quicklime, which property alſo increaſes the fuſibility of the alkaline ſalt, or its diſpoſition to melt ; therefore to deprive the alkaline ſalts of the aerial acid which they had imbibed from the air, or from the hard water uſed to diſſolve them, quicklime may be uſed, not only without injury to the Pot Aſh, but with advantage.

There is no ſubſtance in nature known to poſſeſs ſo great a ſhare of the aerial acid in its compoſition as that which makes the beſt of quicklime. This aerial principle being expelled from *limeſtone* by fire, in the manufacture of quicklime, it becomes a *cauſtic* ſubſtance, ever ready to regain its natural ſtate ; and it will moſt greedily abſorb what it has been ſo violently deprived of, whenever circumſtances favour it.

Preſent alkaline ſalts in a *mild* ſtate to quicklime, and in proportion as they poſſeſs this aerial principle, it will be reſtored to the quicklime, which will thereby become mild, or ſlacked, leaving the alkaline ſalts poſſeſſed of their original cauſtic property.

The foregoing principle admitted, directs to the proper uſe of lime, and ſhews that after it has

thus acted on the alkaline ſalts, it ſerves only as a ſtrainer, and therefore the lye ought to be as carefully drawn from it, as from any other earthy impurity. It alſo ſhews the advantage that will reſult by excluding the air as far as practicable, from the wood aſhes deſigned for this manufacture, from the lye, and the ſalts, through every operation of the following

PROCESS, for the MANUFACTURE of POT ASH.

THE firſt operation conſiſts in *leeching*, as for Pearl Aſh.

This has been ſo particularly treated of, that a repetition would be uſeleſs, although the moſt minute attention to every circumſtance there noticed, is indiſpenſible. A difference too, to be obſerved, is, that here unſlacked lime may be uſed. The ſtraw upon the falſe bottom of the vat is to be covered firſt with wood aſhes, then as much unſlacked lime is to be thrown over it, as, when ſlacked, will make a layer of three or four inches; that the lye paſſing through may not only be ſtrained, but that it may acquire a more cauſtic quality. An additional quantity of lime may ſometimes be requiſite to be thrown into any part of the vat with the wood aſhes, when they have been rendered more mild than uſual, by long expoſure to the air.

When

When the lye is leeched and ſettled, it is to be drawn off into the kettles, and boiled down, for

The Separation of Neutral Salts.

THE boiling is to be continued until a ſcum is obſerved to collect on the ſurface of the lye, or, until it will weigh a little more than one quarter heavier than pure rain water. It is then to be taken from the kettles into a receiver, where it is to be again ſettled by throwing into it another quantity of lime, unſlacked,* to increaſe its cauſticity. The

* Here an enquiry preſents itſelf that may be thought to deſerve more particular diſcuſſion. How much quicklime is to be uſed in a given quantity of lye? No explicit anſwer can be given to this queſtion. No definite quantity can be determined on for different parcels of lye, which already, without the addition of lime, poſſeſs different degrees of cauſticity. (e. g.) From wood aſhes recently burned, immediately taken from under a furnace before they are cold, and carefully leeched with pure rain or river water; or, if early in the ſeaſon, even with good ſpring water, no quicklime will be requiſite. The ſalts have not been expoſed to abſorb the aerial acid, they will therefore be ſufficiently cauſtic, and will melt like oil. Take wood aſhes of the ſame deſcription, that have been expoſed to the air for months together, let them be leeched in the common mode, with water from the ſame ſpring in autumn, when it runs low and becomes hard; the ſalts will have abſorbed ſo much of the aerial principle from the air, and from the water; that unleſs quicklime be uſed to abſorb it from the lye again, they will prove extremely hard to melt.

A ſimple experiment will ſhew the difference between the two lyes, and tends to eſtabliſh the principle, that the ſtate of the laſt lye depends on the aerial acid. To a glaſs of it, pour by degrees a little ſharp vinegar or other acid, and it will immediately be thrown into a violent ſtate of effervescence, cauſed by the ſudden expulſion of air the alkali has abſorbed, which muſt give place to the new union with a ſtronger acid. But if the alkali is completely cauſtic, no ſuch

effervescence

The receiver is to be covered, where the lye ſhould reſt until it is cold, when it is to be drawn off as carefully from a faucet placed above the ſediment, as directed for the white lye, deſigned for Pearl Aſh. In this way the neutral ſalts and all ſediment will be left in the receiver, and the lye prepared for the laſt boiling. For this, the utenſils, the kettles, and every thing about them, ſhould be very clean, that no impurity fall into the lye. After it is drawn off and conveyed again into the kettles, they ſhould be covered until the lye begins to boil, that it may not loſe of its cauſticity. The covers may then be taken off, to favour its evaporation. When dried down to ſalts, the fire is gradually to be raiſed; the kettles again covered for

Melting.

IF the precautions recommended have been duly attended to, this operation, often tedious and expenſive, hazarding the loſs of kettles, and perplexing the workmen, becomes at all times eaſy and expeditious, and *melting down* terminates the proceſs to the complete ſatisfaction of the operator. For by the time the alkaline ſalt is well melted, the laſt impurity, the black colouring matter is deſtroyed; but, if the alkaline ſalt

effervescence is seen immediately on the mixture of an acid; there is no air to be expelled, and the union of the acid with the alkali quietly takes place.

When then a violent effervescence suddenly commences on the mixture of an acid with the alkali, quicklime may be added to the lye with advantage.

ſalt is not cauſtic, by being kept or freed from the aerial acid, and the neutral ſalts have not been ſeparated; it is extremely hard to melt. And the black colouring matter* is ſo ſtrongly united to it, that if after a tedious length of time with exceſſive fire, it is melted without breaking the kettles, the Pot Aſh will be found red and foul, although the lye has been leeched and ſettled in the moſt careful manner.

Dr. Lewis, one of the moſt eminent of modern chemiſts, in his valuable little treatiſe on Pot Aſh, obſerves, when treating of the mixture of ſea ſalt with American aſhes, that "as almoſt all the common ſorts of ſea ſalt participate of the bittern of ſea water, the combination of the vitriolic acid of that ſalt with the inflammable matter during fuſion is probably the origin of the ſulphureous taint;" (*i. e.* the black colouring matter) "in Pot Aſh." If this is true, we are taught to explain the effect that all other neutral ſalts, as well as ſea ſalt, have on Pot

* This colouring matter has been improperly called the *cauſtic* ſulphur, and the *cauſtic* oil, from a conjecture that it was the cauſe of *cauſticity*. This errour probably was ſuggeſted by obſerving that black ſalts oftentimes retained a conſiderable degree of cauſtic ſharpneſs, which they loſe at the ſame time the colouring matter was deſtroyed by calcination. However reſpectable the authorities are that formerly held this opinion, it is now a fact well eſtabliſhed, that the *cauſticity* of the alkaline ſalt does not reſide in the inflammable principle (*i. e.* in the black colouring matter) but that it is really diminiſhed in proportion as the inflammable principle abounds.

Neither has this colouring matter the properties of an oil—if it had, it would invariably form ſoap by its union with the alkali.

Pot Aſh; for all other neutral ſalts found with the alkaline in wood aſhes, are combinations of the vitriolic acid with different baſes; therefore, the ſame effect is to be expected from the vitriolic acid in their combination, as from the ſame acid combined in the bittern of ſea water. Again, if hard water has been made uſe of inſtead of ſoft, it has a ſimilar effect on the Pot Aſh; the ſalts are very hard to melt, and the black colouring matter remains; and it becomes almoſt impoſſible by the common mode of manufacturing to deſtroy it.

Water is made hard, not only by neutral ſalts, but by the aerial acid.*

Well and ſpring water, although at ſometimes ſufficiently ſoft and pure, when the ſprings are low, become hard by this impregnation.

Here is diſcloſed the myſterious cauſe of Pot Aſh ſalts melting eaſier in the ſpring and the fore part of ſummer, when the whole earth is filled with water, than at the cloſe of the ſeaſon, when it is much exhauſted, and the ſprings run low. At this latter ſeaſon moſt ſpring water is hard, and it is generally ſaid to be impoſſible to make good Pot Aſh. Although rain or river water is always to be preferred where it can be had, eſpecially at the ſeaſon when it is thought impracticable to make good Pot Aſh: Yet, indiſputable experiments have proved, and muſt convince all who make

* The gaz which waters frequently contain, is another cauſe of the hardneſs of water. Chemic. Dictionary. Note to the article water.

make them fairly, that, according to the foregoing theory, even lye made with ſpring water may be ſo deprived of neutral ſalts and the aerial acid, as that Pot Aſh of a *ſuperior quality* may eaſily be made at *any* and *every* ſeaſon of the year.

If this is well underſtood, the workman will no longer be aſtoniſhed that his Pot Aſh has ſometimes proved bad; although, as he ſuppoſed, he had uſed the ſame method to cleanſe it, (i. e. he had leeched, ſettled, and drawn the lye from all earthy impurity in the ſame manner) as when it turned out good. He will hereafter regard the neutral ſalts as an impurity, and attend particularly to their ſeparation, while through the whole proceſs he ſtrives to prevent the union of the aerial acid with the alkaline ſalts, or carefully deprives them of it when unavoidably combined. This done, melting down will ſoon be effected, by gradually raiſing the fire until a red heat is produced. Except when there is occaſion to examine the melting maſs, or to ſtir it together with a ladle, it ſhould be kept covered, increaſing the fire until it becomes an uniform thin fluid.

Iron kettles for coolers are now to be made ready, by heating them at the mouth of the furnace. A little tallow may be lightly rubbed over the inſide ſurface of them, to prevent too ſtrong an adheſion of the Pot Aſh to the iron, which ſometimes happens and is troubleſome. The furnace is to be well tended with a continual ſupply of dry fuel to keep up a very briſk fire, to-

ward the close of the process. In this state, the melted salt need be continued but for a short time to destroy the inflammable principle, or black colouring matter; the destruction of which may be known by the easy experiment of making a very strong solution of the Pot Ash in a cup of water, immersing therein a piece of silver or bright tin; if by this, the metal is not tarnished, the process is finished; and the Pot Ash is immediately to be dipped off into the coolers, taking especial care not to suffer the least abatement of fire until the kettles are emptied.

When the Pot Ash becomes hard in the coolers, and cool enough not to endanger burning the cask, before it has attracted moisture from the air, it should be packed in dry, tight, new casks, that the air may not form a crust upon its surface.

One general observation applicable to most kinds of business is peculiarly adapted to both the preceding processes, viz. that every operation well conducted, makes easy and shortens those that come after, and is of so much consequence to the succeeding ones, that it is best to repeat it, whenever any one is interrupted.

Such management of the business, will, at once, put an end to all well grounded complaints, against ashes, exported from Massachusetts. Instead of *second* and *third sort*, which are a dead loss to the manufacturing interest, there need not be a single cask but of an excellent quality. We shall no longer hear of "mixed parcels of ash-

es," ſo various in their appearance, as to beget unfavourable ſuſpicions of their being the genuine ſalt. And a faithful compariſon with the exports of our ſiſter State, New-York, formerly our rival in this important branch of commerce, will ceaſe to be to our diſadvantage. And while there is a market for aſhes, thoſe exported from Maſſachuſetts will meet with a quick ſale, and at the higheſt price. Added to this, which is perhaps the ſtrongeſt and moſt perſuaſive argument for the mode of manufacturing on the principles here advanced; experience will prove it leſs troubleſome, more expeditious, and leſs expenſive, than to manufacture ſuch aſhes as turn out of inferiour quality, and are denominated ſecond and third ſorts.

EXPERIMENTAL

EXPERIMENTAL ASSAY OF ASHES.

THE ſeveral operations to free aſhes from impurity, point to "the more effectual inſpection of the ſame;" whereby the quality of any parcel may be more fully aſcertained.

A ſolution of Aſhes in rain water will determine what proportion of ſediment, or indiſſoluble foul earth, is inveloped with the ſalt. By filtering it through looſe wrapping paper, what remains on the filtering paper may be accurately weighed; it will alſo ſhew the black colouring matter of red Pot Aſh floating in the ſolution, like a mixture of lampblack. The weight of this impurity being comparatively nothing, the degree of foulneſs is judged of by the deepneſs of the dye.

Except ſea ſalt, the neutral ſalts are eaſily diſcovered by the ready method practiſed by Mr. Blodget: It is to diſſolve as much aſhes as can be taken up in a tumbler of boiling rain water, and to cool it ſuddenly by immerſing the tumbler into cold water. The neutral ſalts will haſtily ſhoot, and form an apparent congelation. Sea ſalt, not being obedient to the ſame law, but being equally ſoluble in cold as in hot water, is not diſcovered by this mode; but by ſlow evaporation.

Sea, or common ſalt, is ſeldom found in quantity, either in Pot or Pearl Aſh, unleſs added by deſign. A pretext is ſometimes made uſe of, that it facilitates the melting of Pot Aſh. Some have been

been induced to believe this, but they have deceived themſelves; and where melting is the only aim, a ſingle fair experiment will determine them to give up the practice, in favour of the prudent uſe of quicklime, previous to the melting ſtage of the buſineſs.

If Pot or Pearl Aſh is overcharged with neutral ſalts, it is ſuſpected by the touch and taſte. If inſtead of the *cauſtic* alkaline ſalt, any other ſalt be mixed in Pot Aſh, it will not give that acute ſenſation of heat, on handling, or to the taſte, as the genuine ſalt never fails to excite; for all neutral ſalts, except the *metallic*, excite rather the ſenſation of cold than of burning heat. The adulteration with common ſalt has this effect on the Pot Aſh in a remarkable degree. A ſolution of Pot or Pearl Aſh, containing common ſalt, may alſo be diſcovered by its taſte, if compared with a ſolution of aſhes known to be free from it: And if theſe ſolutions are made in ſix or eight times their quantity of pure rain water the difference will be very diſtinguiſhable. The degree of adulteration may be found by evaporating a ſolution of aſhes very gradually, until the neutral, and of courſe the common ſalt, will cryſtalize, while the alkaline is held in ſolution.

But, as the quantity of alkaline ſalt is the object of the aſſay, and not what are the different kinds of neutral ſalts blended with it, in Pot or Pearl Aſh; the peculiar properties of that ſalt furniſh another mode of examination that cannot deceive.

Alkaline ſalt is well known to poſſeſs the ſtrongeſt diſpoſition to unite with acids, to a certain point called *ſaturation*; which totally deſtroys the properties of both, conſtituting a neutral ſalt: until ſufficient acid is added to the alkaline ſalt to bring it to this point, the alkali predominates, and the mixture retains its alkaline character; beyond it, the acid prevails.

A clean ſolution of Pot or Pearl Aſh, freed from all ſediment, contains nothing but ſalt. The queſtion is, what portion of the contained ſalt is alkaline? Add an acid until the ſolution is neutralized, and mark the quantity of acid conſumed. If neutral ſalts have been already blended in the ſolution to be aſſayed, it is plain it will not take up as much acid to ſaturate it as an equal weight of a ſolution where no neutral ſalts are blended. Thoſe aſhes therefore which will take up the greateſt quantity of acid to ſaturate them, contain moſt alkaline ſalt.

The point of ſaturation is pretty well known by the taſte, to thoſe accuſtomed to compound acids with alkalies. The ſour ſharpneſs of the one, and the corroſive heat of the other; are not to be diſtinguiſhed in the ſaturated mixture, becauſe they have deſtroyed each other. A ceſſation of the effervescence that takes place on the union of an acid with a *mild* alkali, is the uſual method to determine this point. But, if the alkali is completely *cauſtic* no effervescence takes place, for want of the *aerial acid*, that, diſcharged by the

union

union of the *mild* alkali with a ſtronger acid, occaſions its efferveſcence.

The diſtinct properties of acids and alkalies in their action on the blue juices of vegetables, have enabled chemiſts to come at this point of ſaturation with the greateſt exactneſs.

Alkaline ſolutions will invariably change the blue of vegetables to green. Acids will change the ſame blue to red,* while the neutral ſalt reſulting from a ſaturation of the two, produces no alteration of colour.

Tinge a ſolution of alkaline ſalt, green, with ſome vegetable blue, add an acid until the blue colour is recovered, and the point of ſaturation is gained. If more acid is added the ſolution will redden.

The infinite variety of blue flowers, in the ſeaſon of them, will ſupply the blue colouring matter

* Profeſſor Bergman ſays, "The general rule, namely, that blue vegetable juices are made red by acids, and green by alkalies, is liable to two exceptions, already known, viz. lackmus is rendered more intenſely blue by alkalies, and indigo diſſolves in vitriolic acid without any change of colour." Vol. II. page 129.

What is ſaid of lackmus and indigo is undoubtedly true; ſtill it does not furniſh any exception to the general rule, when it is remembered that neither of thoſe ſubſtances is of the blue vegetable juice in its original ſtate. Lackmus is a preparation of the vegetable called Archil, which vegetable, in its natural ſtate, gives out a red colour: but when bruiſed, and the red juice is treated in a certain way with lime and volatile alkali, and evaporated to a conſiſtence, it is changed into a blue pigment called Lackmus.

Indigo is well known to be obtained from a vegetable, by fermentation; and fermentation totally changes the property of every vegetable and animal ſubſtance.

ter for this teſt. But they are not always to be had freſh; lackmus, a preparation of archil, is recommended becauſe it is not ſo periſhable.—In want of theſe, during the winter ſeaſon, I accidentally made uſe of the red cabbage; a ſtrong infuſion of it in rain water gives a good blue; and I ſince find this vegetable recommended in preference to all others, for the trial of alkalies and acids.

It is ſimply prepared by pouring boiling water upon the red cabbage leaves, cut ſmall, and let ſtand until cold, when it may be poured off for uſe.

Any acid may be made uſe of, even vinegar. The marine acid, called ſpirit of ſea ſalt, as ſold in the apothecarys' ſhops will be found preferable to any other, for the purpoſe.

Add to one part of ſpirit of ſea ſalt, ten parts of rain water, and the acid will be reduced to a ſuitable ſtrength for the trial.

To aſcertain with the utmoſt preciſion the *abſolute* quantity of what is purely alkaline in any ſolution of ſalts, requires ſo minute an attention to every variation of temperature from hot to cold; to the different degrees of preſſure of the atmoſphere, in damp or dry weather, and to the preciſe ſtrength of the acid made uſe of, as cannot be had without the aſſiſtance of expenſive inſtruments; and would prove much too tedious and troubleſome for common buſineſs.

Chemiſts

Chemical and philoſophical reſearches require this accuracy in experiments, leſt erroneous deductions ſhould be made from their reſults. But it is by no means neceſſary to be thus ſcrupulouſly exact to determine the purity and conſequent comparative commercial value of Pot and Pearl Aſhes. This may be done with great eaſe and certainty, and with little apparatus. The apparatus need conſiſt only of a little vegetable blue, and ſome acid prepared as above—two or three glaſs tumblers, a vial that will contain four ounces of rain water, and a ſmall pair of ſcales and weights ; the weights to conform to the vial and contained water : *e. g.* one weight that will exactly balance or tare the empty vial—one that will weigh preciſely as much as the quantity of rain water the vial will contain, i. e. four ounces.

The four ounce weight may be marked	128
One two ounce do. do.	64
One ounce,	32
One half ounce,	16
One quarter ounce,	8
One eighth,	4
One ſixteenth of an ounce,	2
One thirty-ſecond,	1

By thus marking them they may be denominated carat weights.

Take then one ounce, or thirty-two carats of ſuch Pot or Pearl Aſh, as having been faithfully made from good wood aſhes, is known to be of the beſt quality. Let it be pulverized, that

ſolution may be more ſpeedily made) make the ſolution of it in a tumbler, in four ounces of pure rain water.

Take alſo an ounce of the Pot or Pearl Aſh to be examined, make a like ſolution of it in a ſecond tumbler in the ſame quantity of rain water. When the ſolutions are complete, and the ſediment of each has ſubſided, pour carefully from the firſt tumbler half an ounce, or ſixteen carats by weight, of the clear ſolution; add to it one tea ſpoonful of the vegetable blue infuſion—take by weight of the prepared acid—add of it gradually to the ſolution that has in it the vegetable blue, and it will be found gradually to change colour, until, by repeated addition, the blue colour is reſtored, which ſhews the point of ſaturation. The laſt additions ſhould be made with great caution, or too much acid will ſuddenly change the colour of the ſolution to a deep red. To carry this teſt to a point inſtantly diſcernable, I have generally added the acid until it gave the ſolution the firſt tinge or bluſh of red, which although a degree beyond ſaturation, is as preciſe a point, and eaſily determined. After this, the remaining acid is to be carefully weighed, and the quantity conſumed in the trial to be noted.

Proceed immediately to the examination of the ſolution in the ſecond tumbler. Take the ſame quantity, i. e. half an ounce by weight. Uſe the ſame teſt, and when, by the ſame caution, under

ſimilar circumſtances, the ſolution is brought, by the acid, to the very firſt bluſh of red, weigh the remaining acid, which will ſhew the exact quantity conſumed.

If then the ſixteen carats weight of the ſolution of the firſt tumbler, which may be called of the ſtandard aſhes, has taken up forty carats weight of prepared acid; and the ſame weight of the ſolution of the ſecond tumbler, has taken but thirty-ſix carats to bring it to the ſame point, it is plain, that although the quantity of ſalt contained in each be the ſame, yet, of the ſalt that is valuable, i. e. the alkaline ſalt, there is a difference between them of ten per cent. The remaining ſalt of the ſecond aſhes being of a different kind, ſhews the exiſtence or mixture of ſome neutral ſalt that ought never to have been blended, or ſhould have been carefully ſeparated in the manufacture.

Every expenſe on ſuch aſhes (the original price of the ſtock only excepted) being the ſame with the firſt, the profit of it muſt be much reduced.

In this way may be determined the comparative worth not only of Pot and Pearl Aſhes, but of all Pot Aſh Salts; and the manufacturer need no longer be ſubject to impoſition in the purchaſe of them. A very little practice will familiarize and make eaſy the trial, and it will be found ſufficiently expeditious. Thoſe who collect aſhes at the ſtores in various parts of the country, may have it in their power

to

to aſcertain the quality of their purchaſes : and the exporters, if they pleaſe, may determine, as well as the Inſpector, what aſhes will be moſt profitable to the conſumer. The manufacturer likewiſe may always know how his aſhes ought to be received at market ; and blind indeed muſt he be to his pecuniary concerns, if ever he ſuffers aſhes of the *third ſort* to be ſent from his works. Let him rather, if by accident he is unfortunate in a proceſs, and his aſhes prove third ſort, keep the advantage of working them over to himſelf : This will at all times afford him greater profit than to diſpoſe of them in any other way.

Well perſuaded that nothing is wanting but the practice, to convince of this fact ; may we not expect the time, which probably is not far diſtant, when what are now denominated *third ſort* of aſhes, may not be known or heard of in the Maſſachuſetts market ?

APPENDIX.

APPENDIX.

PEARL ASH FURNACE.

IT is not easy to give an accurate description of a Furnace, unless by reference to a plate where it is delineated. A general idea, however, of the Furnaces employed in the business treated of, may not be altogether useless.

A Furnace, whether for scorching or pearling, should be exactly of the same construction: It is properly called a *reverberatory Furnace*, and differs very little from the *reverberatory Furnace* "said to be the invention of an English physician of the name of Wright: the use of which was first introduced in England for smelting ores, about the end of the last century."*

To describe the pearling Furnace in a more familiar manner:—The form of the body of it may be said to be very much like a baker's oven, open on one side. The greatest extent of the hearth is in length six feet, in width four. The fire place and ash hole are on the side of the opening. The fire place is separated from the body of the Furnace by a partition wall, raised about two or three inches from the hearth, running along the whole length of the side. This wall leaves an opening of about four or five inches above it, for the passage of the flame to the body of the Furnace. The grates to support the fuel

ſeparate the fire place from the aſh hole, and ſhould be ſunk about ſix or eight inches below the level of the hearth.

Formerly the pearling Furnace was built with a fire place on each ſide; but of late, the fire place on one ſide is found equally to anſwer.

The diſtance of the roof on the inſide of the Furnace, from the hearth to its crown or higheſt part, ſhould not exceed fourteen or fifteen inches.

It is uſual to have two chimneys to the body of this Furnace; one at the entrance, to receive the flame and ſmoke, when the door is open; the other oppoſite to it, at the fartheſt end.

This Furnace has alſo two doors; one at the fire place, about 12 inches wide, another at the opening at the front of its body, about 18 inches wide, and ten high; through which the ſalts are thrown into it.

The fire is led to play throughout a well conſtructed Furnace, by three or four flues judiciouſly diſpoſed around it, at the bottom of the wall, directly upon its hearth. Theſe openings communicating with the chimneys, cauſe a draught which circulates the flame over every part of it.

POT ASH FURNACE.

THE Furnace in uſe, for manufacturing Pot Aſh, is of a different conſtruction. It conſiſts of two large iron boilers, or kettles, ſet in brick

work,

work, that will hold from 50 to 70 gallons, measuring about three feet over the top; they ſhould be very thick at the bottom to endure the fire, and provided with covers of plated iron. Under the kettles is the fire place and aſh hole. At the mouth of the fire place is the door, at the fartheſt end of it is the chimney. The grates that ſeparate the fire place ſhould be ſunk below the bottom of the kettles at a diſtance not exceeding 14 inches; the width of the fire place door ſhould be about 18 inches.

It is eaſy to conceive that by this conſtruction, whenever the fire is urged ſo ſtrongly as to produce a red heat in the kettles, and ſometimes beyond it, that the draught from the aſh hole will drive a great portion of the fire into the chimney, and even force the flame out at the top to a conſiderable height. This is what generally happens on *melting down*.

Being deſirous to attend particularly to this operation, and aware of the inconvenience it muſt occaſion, when performed in the town of Boſton, where every blaze, out at the top of a chimney, excites an alarm, and ſubjects the proprietor of it to an expenſive penalty; I applied to Mr. Heath, an intelligent artiſt, an inhabitant of the town, to vary the conſtruction of the Pot Aſh Furnace ſo as to obviate this difficulty. He has effected the purpoſe completely. Inſtead of carrying out the chimney from the fartheſt end of the fire place, he there left a ſufficient vacancy beyond the

kettles, for the fire to paſs up to the flues, which he opened, one on each ſide the kettles, to return the flame round them toward the mouth of the Furnace, and conduct it into the chimney raiſed directly over the door.

This improvement leſſens the conſumption of fuel, for by it, the ſame fire is brought to act a ſecond time on the kettles, is nearly expended round them, and not waſted in the chimney.

POSTSCRIPT.

IT would be injuſtice to the remarks on the ſubject of Pot and Pearl Aſhes, not to notice an advertiſement which appeared in the Gazette of the United States, publiſhed July laſt, at Philadelphia, and ſigned Samuel Hopkins.

It is there aſſerted as an advantage ariſing from Mr. Hopkins's method of manufacturing Pearl Aſh, that "by calcining the aſhes before the leys are drawn from them, we obtain as great a quantity, at leaſt of Pearl Aſhes, as of common black ſalts;" and Mr. Hopkins adds, "Pearl Aſhes generally ſells, when at market £50 per ton. The higheſt price for black ſalts is £25 per ton, and if converted into Pearl Aſhes, it requires as much more labour and fuel as in the firſt inſtance, and a loſs from twenty-five to thirty per cent." Could this be realized, lucrative indeed would be the buſineſs. But if it ſhould turn out that ſpurious aſhes are the product of his ſuppoſed improvement; that they are the alkaline ſalt confounded with a variety of neutral ſalts, and a greater portion of earth than are found in Pearl Aſh manufactured after the uſual mode; although ſo bleached by the action of the fire and air, as to give it the appearance of good "Pearl Aſhes of a very fine white colour;" yet when accurately analyzed, even the 25 or 30 per cent. ſuppoſed to be ſaved in the weight of the Pearl Aſh, may diſcover itſelf to be ſtill the earthy and ſaline impurity, although deprived of colouring matter by calcination.

If this is the reſult of Mr. Hopkins's method, it will not be deemed preſumptuous to call in queſtion his mode of manufacturing, although ſanctioned by a patent, and recommended by the opinion of ſome of the moſt celebrated characters in the United States—characters juſtly celebrated

ed for their distinguished eminence in science.* In this instance, however, they appear complaisantly to have subscribed to *Mr. Hopkins's definition*, where he says, "Black salts are made by boiling down the leys from common wood ashes, until they are perfectly dry;" and "Pot Ashes are made by melting the black salts in a very strong fire, and lading it out into coolers;" without the least intimation that from the alkaline salt all others are to be separated, to make the *best* of ashes:—For, in the alkali alone is the excellence of Pot or Pearl Ash. Indeed some have vainly imagined that by Mr. Hopkins's method of manufacturing, an actual *transmutation* of 25 or 30 per cent. is effected, and that the saline impurities are converted into genuine alkaline salt.

The gentlemen referred to, who gave Mr. Hopkins their certificate, could not entertain such an opinion; for, although *tartar* is alkalized by fire, and *nitre* by the peculiar inflammability of its acid, when burned, leaves its alkaline basis uncombined, yet the strongest fire of a glass house has never effected the separation of the vitriolic acid from its alkaline basis in vitriolated tartar, or the marine acid from the mineral alkali in sea salt. By force of fire they may both be melted, and perhaps evaporated; but when dissolved, or condensed, they are found the same, and may again be chrystalized. No chemical fact is better known, or more thoroughly established, than that the union of acids and alkalies in neutral salts, is too strong to be in the least effected by any sort of earth yet known; therefore it is not to be expected that either the acid of neutral salts will be dissipated, or any new combination will take place in consequence of calcining them with the earth of wood ashes.

Mr. Hopkins also says, that "Pot Ashes made from calcined ashes are allowed to be much superior to those made in the common mode."

However fair the Pot Ash may be made to appear by the previous calcination, unless the neutral salts have been separated, it cannot be equally as good as that which is properly made, because it does not contain the same proportion of alkaline salt.

There cannot be a more decisive test to evidence this, than to take a specimen of each, and with the same ingredients, under similar management, to ascertain the quantity of soap they severally produce.

* *David Rittenhouse, Benjamin Rush, James Hutchinson, Benjamin Say, Casper Wister, jun. and John Pennington.*

FINIS.